

PATENT COOPERATION TREATY


PCT

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference E-2368/04	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/IB2004/002954	International filing date (day/month/year) 10.09.2004	Priority date (day/month/year) 11.09.2003	
International Patent Classification (IPC) or national classification and IPC H01L39/14, H01L39/24			
Applicant EDISON S.P.A. et al.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input checked="" type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand 11.07.2005		Date of completion of this report 18.11.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer Köpf, C Telephone No. +49 89 2399-2365	



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/IB2004/002954

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1-6 as originally filed

Claims, Numbers

1-21 received on 11.07.2005 with letter of 11.07.2005

Drawings, Sheets

1/1 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-21
	No: Claims	
Inventive step (IS)	Yes: Claims	1-21
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-21
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1 Reference is made to the following documents:

D1: OBERLY C E ET AL: "The importance of interfilamentary barrier resistance in YBCO coated conductor to minimize ac losses" INTERNATIONAL CRYOGENIC MATERIALS CONFERENCE, MADISON, WI, USA, 16-20 JULY 2001, AIP CONFERENCE PROCEEDINGS no. 614B, 2002, pages 621-630, XP002311092

D2: DE 40 04 908 A (DAIMLER-BENZ AG) 22 August 1991

D3: WO 01/18885 A (CAMBRIDGE UNIVERSITY; GLOWACKI BARTLOMIEJ ANDRZEJ ET AL) 15 March 2001

2 INDEPENDENT CLAIM 1

2.1 The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (the references in parentheses applying to this document, cf. page 625, last paragraph - page 626, paragraph 2; figure 5) a superconductive composite tape comprising a (metallic) substrate and a layer made of superconductive material (YBCO), said superconductive material layer comprising a plurality of superconductive filaments, which are substantially parallel to one another and to the longitudinal axis of the tape and are spaced out from one another (by grooves), wherein each filament is delimited by a pair of resistive barriers (by filling the grooves).

The subject-matter of claim 1 differs from this known superconductive composite in that the tape comprises a coating made of a conductive coating material, the filaments being embedded in the coating, and in that each filament is delimited by a pair of side walls provided with resistive barriers.

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

- 2.2 The problem to be solved by the present invention may be regarded as how to provide a composite tape with low energy dissipation in time-varying fields (AC loss reduction by electromagnetic uncoupled filaments) and at the same time with good thermal and electrical stabilization.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

The prior art does neither disclose nor suggest sidewalls provided with resistive barriers in combination with filament embedding by a conductive coating. Those teachings are apparently at odd with each other: Document D1 only shows filling of the interfilamentary grooves with silver or dielectrics to obtain various barrier resistances, while documents D2 or D3 describe only embedding/coating the filaments with conductive (silver or ferromagnetic) material. After creation of the resistive barriers, the tape of D1 cannot be coated with a conductive material so as to embed the filaments. The skilled person would have no reason to combine the conductive coating of D2 or D3 with the resistive barriers of D1.

3 INDEPENDENT CLAIM 12

Claim 12 relates to a method of fabrication of superconductive composite tapes including all the features of claim 1. The subject-matter of said claim is therefore also new (Article 33(2) PCT) and involves an inventive step (Article 33(3) PCT).

4 CLAIMS 2-11, 13-21

Claims 2-11 and 13-21 are dependent on claims 1 and 12, respectively, and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**INTERNATIONAL PRELIMINARY
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(SEPARATE SHEET)**

International application No.

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Re Item VII

Certain defects in the international application

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D2 (D3) is not mentioned in the description, nor are these documents identified therein.

The description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT.

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CLAIMS

1. A superconductive composite tape (1), comprising a substrate (2) and a layer (5) made of superconductive material, said superconductive material layer (5) comprising a plurality of
5 superconductive filaments (11), which are substantially parallel to one another and to a longitudinal axis (A) of the tape and are spaced out from one another; the tape being characterized in that it comprises a coating (30) made of a conductive coating material, the filaments (11) being embedded
10 in the coating (30); and in that each filament (11) is delimited by a pair of side walls (15) provided with resistive barriers (25).
2. The tape according to Claim 1, characterized in that the
15 resistive barriers (25) are defined by respective portions (26) of the side walls (15) in which the superconductive material has a structure modified with respect to the body of the superconductive material layer (5).
- 20 3. The tape according to Claim 1 or 2, characterized in that the filaments (11) are separated from one another by grooves (14) formed through said superconductive material layer (5) throughout the whole thickness of said superconductive material layer (5).
- 25 4. The tape according to Claim 3, characterized in that the grooves (14) are interrupted by transverse bridges (17) for connection between adjacent filaments (11).
- 30 5. The tape according to Claim 3 or Claim 4, characterized in that the grooves (14) extend in depth up to the substrate (2).
6. The tape according to any one of Claims 3 to 5, characterized in that it comprises at least one buffer layer
35 (4), interposed between the substrate (2) and the

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superconductive material layer (5), the grooves (14) extending through the superconductive material layer (5) and through the buffer layer (4) up to the substrate (2).

- 5 7. The tape according to any one of the preceding Claims, characterized in that the coating material is a metal material.
- 10 8. The tape according to any one of the preceding Claims, characterized in that the coating (30) fills the grooves (14) and coats the filaments (11).
- 15 9. The tape according to any one of the preceding Claims, characterized in that it is wound on itself around said axis (A) to form a thread (33) in which said filaments (11) are substantially parallel to said axis (A).
- 20 10. The tape according to any one of the preceding Claims, characterized in that it is twisted on itself along said axis (A) to form a tress-like thread (33), in which the filaments (11) are substantially spirally wound with respect to one another.
- 25 11. The tape according to any one of the preceding Claims, characterized in that the filaments (11) are connected to one another by transverse bridges (17) made of superconductive material.
- 30 12. A method of fabrication of superconductive composite tapes, comprising a step of providing a superconductive composite tape (1) having a superconductive material layer (5) positioned on a substrate (2), and a step of forming in the superconductive material layer (5) a plurality of superconductive filaments (11) delimited by respective pair of
- 35 side walls (15), the filaments (15) being substantially

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parallel to one another and to a longitudinal axis (A) of the tape and being spaced out from one another; the method being characterized by further comprising a step of providing the side walls (15) of the filaments (11) with resistive barriers (25), and a coating step, in which the filaments (11) are embedded in a conductive coating material that forms a coating (30) of the tape (1).

13. The method according to Claim 12, characterized by comprising an etching step, in which a plurality of grooves (14) is dug through the superconductive material layer (5) throughout the whole thickness of said superconductive material layer (5) in order to delimit the filaments (11); said resistive barriers (25) being formed in said etching step, by modifying the structure of the superconductive material of said side walls (15).

14. The method according to Claim 13, characterized in that, in the etching step, the grooves (14) are dug in discontinuous stretches, in such a way that each groove (14) is interrupted by transverse bridges (17) connecting adjacent filaments.

15. The method according to Claim 13 or Claim 14, characterized in that, in the etching step, the tape (1) is dug up to the substrate (2).

16. The method according to any one of Claims 13 to 15, characterized in that the tape (1) comprises at least one buffer layer (4) set between the substrate (2) and the superconductive material layer (5), and the etching step is carried out through the superconductive material layer (5) and through the buffer layer (4) up to the substrate (2).

17. The method according to any one of Claims 12 to 16, characterized in that the coating material is a metal

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material.

18. The method according to any one of Claims 12 to 17, characterized in that, in said coating step, the coating material fills said grooves (14) and coats said filaments (11).
19. The method according to any one of Claims 12 to 18, characterized in that it comprises a step of winding the tape (1) on itself about said axis (A) to form a thread (33) in which the filaments (11) are substantially parallel to said axis (A).
20. The method according to any one of Claims 12 to 19, characterized in that it comprises a step of twisting the tape (1) on itself along said axis (A) to form a tress-like thread (33) in which said filaments (11) are substantially spirally wound with respect to one another.
21. The method according to any one of Claims 12 to 20, characterized in that it comprises a step of connecting the filaments (11) to one another via transverse bridges (17) made of superconductive material.

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